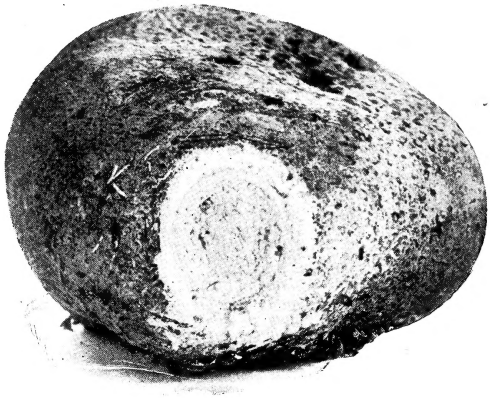

Fig. 1.—Cankers on Scleroderma vulgare, caused by Cephalothecium roseum. These cankers are of a light pink color.

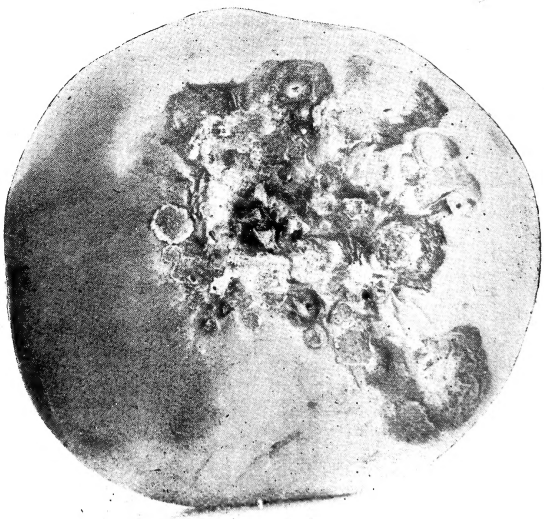

Fig. 3.—The so-called pink rot of apples. This disease is caused by Cephalothecium roseum, which enters through the scab spots on the fruit. The disease appears only after picking, while the apples are piled or stored in barrels. It is sometimes very destructive.

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A Fungus Living as a Parasite upon Another Fungus.

BY H. H. WHETZEL,

Assistant Professor Plant Pathology, Cornell University.

It is not a rare thing to find certain fungi living as parasites upon other fungi. Many such cases are on record, and, in fact, some parasitic fungi are known to live only upon certain fungous hosts. Professor Atkinson calls attention to such a case in his Mushroom book, where Tremella mycetophila is shown living as a parasite upon Collybia dryophila. Several times during the past four or five years I have collected Scleroderma vulgare about Ithaca, the fruit bodies of which were covered by pink spots or cankers. These appear as depressions in the thick rind of the puffball, and are always of a light pink color. The general character of these spots shows very well in Figure 1. A more careful examination of the cankers shows that the pink color is due to the mass of spores of the parasite, which are produced in great abundance. These spores when germinated and grown in pure culture give rise to a mycelium from which

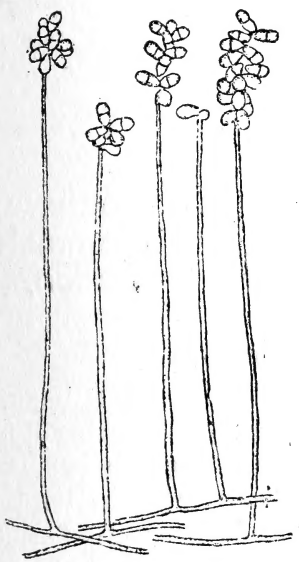

Fig. 2.—Spore stalks of Cephalothecium roseum, bearing a cluster of spores at their tips. [After Van Hook.]

are produced upright spore stalks and the typical spores on the ends of these stalks. The parasite is readily recognized as Cephalothecium roseum. This fungus is a very common one, growing on dead and decaying substances everywhere. Some years ago it was observed to be more or less parasitic on apples, entering through the spots made by the scab fungus, and both the Geneva and Cornell Stations issued a bulletin in regard to the matter.* That the Cephalothecium is a parasite on the Scleroderma seems to be quite certain, although I have not yet carried out infection experiments. I have found the parasite on both young and old Sclerodermas, and in no case did the host seem to be overripe or injured in any other way. The general characters of Cephalothecium roseum are shown in Figure 2. The appearance of the parasite on apples is shown in Figure 3. The writer would be very much pleased to receive specimens from any reader who may chance to find this parasite upon Scleroderma.

On the Hibernation of the Jumping Mouse, and Notes on the Check List of the Mammals, Issued by the Department of Education, Toronto.

BY W. E. SAUNDERS, LONDON, ONT.

In December of 1908 I received from Mr. A. H. Kilman, of Ridgeway, the following note on a Hibernating Jumping Mouse, Zapus Hudsonius, which, while not a rare animal, is not at all well known, and I found Mr. Kilman's note so interesting that, with his permission, I send them to you for publication. The letter is as follows :

On Friday evening last, December 18th, Jacob Lown came to my office and threw down on the table a mouse, saying : "I found this funny little fellow dead in the sand at the beach,

*N. Y. C. U. Bulletin No. 207 : N. Y. Geneva Bulletin 227.

where I was digging a trench for the foundation of a building. He must be frozen, he's pretty stiff, but I thought you would like to see it. It is no common mouse."

The "funny little fellow" was a jumping mouse, with the long hind legs, very long tail, red-brown back, lighter sides and white belly, like the kangaroo. On a close examination I found that it was not frozen, but simply dormant, in a state of hibernation. Lown said it was curled up like a ball, imbedded in the sand, but he could not tell how deep, as it tumbled down as he was throwing out the sand from the trench, and he could see the hollow where it had been in the mass of sand that slid down.

The heat of the office soon had its effect. In about two hours the mouse was active, and I placed it under a bell glass and tried food. It would not eat, though I tempted it with nut kernels, breadcrumbs, fresh meat, cheese, etc. My office was warm during Friday night, and on Saturday morning the mouse was very lively. It ate freely. On putting a little snow under the glass the animal ate the snow. Then I placed a dish of water in, and the mouse washed its face, using its short front feet in a way almost human, and stretching them up over its ears it washed the whole head.

All Saturday it was active. Before closing my office for the night I put some fine tow in the cage, a handful, and some blotting paper to absorb the moisture. Then I turned out the natural gas with which the room is warmed, and during Sunday the office became as cold as it is out of doors.

This morning, Monday, I examined my mouse. Out of the tow and the blotting paper, which it had nibbled and torn up, the little animal had, with infinite patience as it would appear, constructed a ball and ensconsed itself in the very middle thereof. I carefully opened the ball and found him with head between his hind feet, his front feet over his eyes, and the tail coiled around the body, a perfectly symmetrical ball of fur, so rigid that I carried it into my house to exhibit to the members of the family, and without a change in the shape of the ball,

returned to its nest, where it now rests in hibernation, awaiting, perhaps, another artificial springtime; or, better, the real summer. Yours very truly,

A. H. KILMAN.

I have received recently a copy of the Catalogue of Mammals, issued November, 1905, by the Department of Education; edited by C. W. Nash. This affords a hook on which to hang some remarks on several species mentioned and omitted.

The Jumping Mouse, *Zapus Hudsonius*, is referred to as :— " Formerly common and generally distributed, but of late years less frequently seen." My own experience does not accord with this, and in the localities from which my information is drawn I cannot believe there has been any diminution of this species, nor do I believe it has ever been anything like as common as the Deer Mouse, which probably outnumbers it the Province over by twenty or fifty to one.

The Northern Jumping Mouse, *Zapus Insignis*, is omitted from the Catalogue. This animal has been taken in Algonquin Park, and at other localities further north, but not to the south of this, so far as I am aware. It is rather rare, so far as known. Its habitat being distant from most students, it is little known.

Synaptomys Cooperi, Lemming Mouse.—It is doubtful if this species occurs in Ontario, the form found here being S. Fatuus. I published in the Ottawa Naturalist the first capture of this animal in Ontario, and erroneously named it Cooperi. The late Robt. Elliot, who took the first specimen, declared it was rather common, but I am inclined to think that his remark was based on a year of extraordinary abundance, as I have been able to find it only in one locality near London, and that is a district where the fauna is very northern.

Microtus Pinetorum, Pine Mouse.—Mr. Nash concludes that this mouse is generally distributed in Western Ontario, but he has only the capture of the first specimens near London on which to base the surmise. I have looked carefully for this animal

without any success whatever, and am inclined to think that it will be found to be rare and local.

Evotomys Gapperi, Red-backed Mouse. — This Northern Mammal is exceedingly rare in the South-western part of Ontario. In fact, there is not a specimen in existence, so far as I know, from the Counties of Huron, Perth, and the country south and west of them, though there is a record of the skull of one being found in the stomach of an owl shot about twenty miles south-west of London. This is absolutely the only instance upon which a surmise as to its occurrence in South-western Ontario can be based, and I have trapped sufficiently to be very sure that it is extremely rare, if it occurs at all.

Phenacomys Latimanus.—North Bay is the most southern part in Ontario that this animal has been taken, so far as I have been able to find out, and it probably does not occur in the more-thickly populated southern district.

Peromyscus Canadensis (The Northern White-footed Mouse). —This species was omitted from the Catalogue, but in Algonquin Park it far outnumbers the other species, but diminishes gradually to the southward, and is entirely absent from the Lake Erie border; the most southern record of capture being at the south-east corner of Lake Huron, where I took it in 1907 and 1908.

Peromyscus Michiganensis.---This species was added to the Ontario list in June, 1907, when I took it at Point Pelee. Further investigation has shown that it is abundant on parts of the mainland nearby, and occurs in moderate abundance throughout the western counties, and as far north as the south - east corner of Lake Huron. It has smaller ears and a shorter tail than the common Deer Mouse, and it never acquires such a bright color on the back as is usual with that species.

Tamias Striatus, Chipmunk. — It is stated that the subspecies Griseus occurs in the western part of the Province. Our Chipmunks appear to be an intermediate form, and in certain districts of South-western Ontario they seem to approach Griseus quite closely.

Sciuropterus Sabrinus (the Northern Flying Squirrel).—This appears to be the common species at Woodstock, while it is entirely absent at London, where Volans is common. It is probable that Volans ranges one hundred or two hundred miles further north.

Sorex Fumeus, Sooty Shrew. — This species appears to be exceedingly rare in Southern Ontario, and is probably not common even in the north.

Sorex Personatus, Masked Shrew.—Rather rare, in marked distinction to the Mole Shrew, which seems to be abundant all over the Province.

Parascalops Breweri.—This Mole has not been taken in the western portion of the Ontario Peninsula, the record for Guelph being, I believe, the farthest west as yet. It has also been taken near Dunnville, from whence I have a specimen. This is a northern species, and while, perhaps, not common anywhere, may be looked for in the greatest numbers in the higher latitudes and altitudes.

Scalops Aquaticus.—This species, not mentioned in the list, is abundant in the extreme south-western portion of the Province, and I have seen its burrows in the Bruce Peninsula. Occasional records have been reported from as far east as Toronto, but it appears to be rare, except along the west end of Lake Erie.

Putorius Cicognani. — This species is marked "Common throughout the Province," but I believe it is much less so than P. Noveboracensis, which is usually the common species. I have not as yet been able to get a positive record of the small Weasel in Lower Ontario, though it doubtless does occur. The fact that the female of the large species is smaller than the male of the small species tends to confuse these animals very much.

It will be seen from the above remarks that there is very little exact knowledge of the distribution and abundance of many of our small Mammals.

Biologic Plant-types.

BY THEO. HOLM, BROOKLAND, D.C.

It is the power, the ability of the plants to adapt themselves to the surrounding medium, that has produced the manifold structures characteristic of the vegetation of our rocks, woods, prairies, lakes, sea-shores, etc. How the reaction is effected within the plant-body we do not know; we only see the result. We see the peculiar dwarfy, matted growth in Alpine and Arctic plants, their dense foliage, and persisting root-system; the taller stature with ample leaves of the herbs that thrive in the shady woods, in contrast to the frequently narrow and deeply-cut foliage of those which inhabit open thickets, plains and prairies; furthermore, the predominance of succulent plants on the dry, sunny cliffs, in the deserts, in the littoral sand-dunes, and the very singular structure possessed by the aquatics.

They are structures acquired by the plants in harmony with climate and soil; structures of such marked aspect so as to appear characteristic or even typical of certain vegetations. Naturally these adaptations are more readily to be perceived in the vegetative than in the floral organs. It is in the roots, the stems and the leaves that we observe these special adaptations, illustrated by their external shape, manner of ramification, protection of buds, method of vegetative reproduction, and the numerous modifications in the internal structures of these organs; more so than in the floral organs, the principal function of which unquestionably consists in maintaining the species, and are less influenced by the nature of the surroundings than the vegetative organs. It so happens that with a special equipment for accommodating itself to the medium, so as to thrive and subsist, the plant—or let us say the species—appears as something more definite, more characteristic, as a "biologic type." To the systematist a plant may rank as an excellent species, or it may be classified amongst species dubiæ, but it will always remain a biologic type. Annuals, as well as perennials, shrubs and undershrubs, deciduous and

evergreen trees, all may be classified as biologic types, but equipped in a different way, even if they occur associated with each other. However, it is not only at the stage of maturity that plants exhibit such remarkable adaptations; at various periods during its life the same individual may pass through several stages of modification until it reaches maturity. In other words, there are biologic types within the same species, the same individual, readily to be noticed, when we follow the development of the plant from the germination of the seed to the death of the individual. The cognizance of the existence of biologic types is not of modern date. Although but vaguely, some of the old writers have touched upon this subject, but it was not until a hundred years ago that botanical science received the first, and truly the first, scientific foundation of this particular chapter of plant-life, when Humboldt called attention to the existence of distinct types of vegetation. To Humboldt it was a very general consideration of the great, the most conspicuous features of vegetation that played the important role for distinguishing his types; it was a very general and highly esthetic point of view, with no attempt to elaborate the special characters of the components. Since then various attempts have been made to analyze vegetations, in order to combine the numerous structures within a few frames, each of which should represent the average typical growth predominant in certain stations; regions, for instance; or deserts, marshes, woods, etc. Or some authors have attempted a classification of these morphological types from a biologic point of view, by enumerating some of the most striking examples in the vegetative growth; such as those of rhizomes, stoloniferous, cespitose, tuberous, bulbous, and the like, with the object of bringing these in harmony with the environment where they occur. However, the result has seldom proved successful, and the greatest difficulty depends upon the fact that even if certain types, so far as concerns habit and structure, may be predominant in the various climates, altitudes, etc., we nevertheless observe that a multitude of others, though much less conspicuous and less frequent, do occur in these same places; nevertheless, an

author has very recently expressed the idea that the different climates may be characterized by means of the biologic plant-types that occur in these. Such fallacy is, of course, the result of studying nature from books only, or in herbaria. It is a too common experience to the field-botanist to observe that certain vegetations are composed of types utterly unlike each other in regard to equipment, and that it frequently seems impossible to state with any precision which of these are to be considered the characteristic of said vegetation.

In our woods, for instance, the vegetation is immensely variable, beside that a number of the most striking biologic types occur only within certain seasons, especially in the early spring. These vernal types become succeeded by estival, more numerous, perhaps, but less interesting from a biologic point of view, until a third, the autumnal vegetation, sets in with a host of highly-specialized types, perennial as well as annual. Whatever classification may be suggested, it is safe to say that a general consideration like that of Humboldt leads us to a more correct and more natural understanding of vegetation than if we begin to bring out the details of each single type, the methods, and means by which these plants have become enabled to subsist and give rise to new individuals. Therefore, it is not the writer's intention to make any attempt to classify, but simply to describe some biologic types in order to illustrate the peculiar variation in equipment possessed by closely allied species or genera, as seedlings, and as mature plants.

As mentioned above, some cases exist where more than one type is represented by the same species, or even by the same individual. Among such types are those in which the vitality of the species becomes prolonged; that, for instance, the same species may be known as an annual and a perennial. This is the case of *Ricinus communis*, which occurs as an annual herb in the temperate climates, but as an arborescent in the tropics.

Cyperus flavescens is an annual in Europe, but is frequently perennial, and sometimes provided with a stoloniferous rhizome in Maryland and Virginia. *Arabis lyrata, Delphinium Consolida,*

and several others vary in this same manner. Of greater interest is, however, such cases where the same individual represents different types, if we compare the seedlings with the mature plant. An excellent illustration of this was observed by the writer in *Ranunculus pusillus*. Several years ago I noticed some peculiar-looking seedlings in a shallow pond near Washington. These seedings were rooting in the muddy bottom, and almost completely submersed. There were two short-petioled cotyledons borne on a slender hypocotyl, and several secondary roots had developed from the nodes of the slender stem; the cauline leaves were long-petioled, and the oval blades often floating. These seedlings thus represented the typical habit of an aquatic, submersed plant, and I was actually unable to determine the genus, or even the family. Some few weeks later I revisited the pond ; there was no water, and the exposed bottom was covered with numerous plants, among which I noticed several flowering specimens of *Ranunculus pusillus*, and this was the plant to which the seedlings belonged. But the habit of the mature plant differs essentially from that of the seedlings. In the former the primary root, the hypocotyl, and the stretched internodes of the submersed stem have faded away entirely, and we meet now with a terrestrial plant in which the roots are fascicled, and the leaves crowded around the base of erect, flowering stems. Two very distinct biologic types are thus represented by this species : an aquatic, submersed, with the internodes stretched, and a terrestrial with the rhizome cespitose, the leaves crowded at the base of the flower-bearing, erect stems. A like variation of type may be observed also in *Ranunculus abortivus* and *R. recurvatus*, in which the seedlings become horizontally creeping by means of secondary roots which develop underneath the cotyledons ; when the plant grows older the hypocotyl and the primary root-system die off entirely, and the individual appears now with the same habit as the mature specimens of *R. pusillus*. The seedlings of *R. abortivus* thus exhibit the same creeping habit as mature specimens of other species, for instance, *R. septentrionalis*, *R. repens*, *R. reptans*, etc. A like deviation in growth

may be observed in *Sanguinaria Canadensis*. During the first two years the hypocotyl persists as a vertical tuber, globose to ovoid, with the primary root still active; while in the mature plant the rhizome is horizontally creeping.

In *Podophyllum peltatum* the very short internodes of the stem are vertical, and subterranean, and it is not until an axillary bud develops that the direction of the stem becomes changed from vertical to horizontal; the axis thus changes from a monopodium to a sympodium, and we notice in the mature individual a long, horizontally creeping rhizome with stretched internodes, covered with scale-like leaves, and provided with strong secondary roots.

Among *Carices* we remember the densely cespitose, broad-leaved species, *C. laxiflora*, *C. Careyana*, *C. glaucodea*, etc., so characteristic of the shady woods, and in which the structure of the shoot is monopodial, with the apex purely vegetative for several years, and with the inflorescences axillary. In *C. marcida*, *C. vestita*, *C. Geyeri*, etc., the rhizome is horizontally creeping, and represents a sympodium, but as seedlings all these *Carices* are alike, and it requires a growth of more than three years before the little shoot indicates whether it is going to develop as a sympodium or remain as a monopodium.

If we now pass to examine the vegetative structures of mature specimens only, we notice a number of biologic types even among closely-allied species. The existence of such very distinct types within the same genus is the more remarkable when we consider the fact that they may frequently be observed in the same kind of soil, and very often associated with each other. Such divergencies in structure of the vegetative organs of allied genera or species are familiar to us, and it is especially the subterranean stems with the roots that express the vitality, the method of vegetative reproduction, and finally the apparent influence of the environment. That aerial and subterranean environment may act directly upon the responsive power of the organ, so as to give rise to structures appropriate for each medium respectively, is undoubtedly true; but there are,

nevertheless, many instances where we are at a loss to understand why or how such structures did originate. Some of the features peculiar to certain species may be readily understood as epharmonic, while others may have been simply inherited from ancestral types, and apparently of no special use to the plant-individual at present. Therefore, we must not expect to find any particular structure of rhizome confined to plants of certain climates, or of certain regions; on the contrary, we notice in our woodland-plants, for instance, many structures which recur in entirely different species inhabiting the prairies, the swamps, or the exposed mountain slopes. Much more susceptible to the influence of environment are the leaves, and we notice in these certain structures which may indicate the nature of the station; for instance, the foliage of sciaphilous species, of many desert plants, bog plants, etc. But it is seldom possible to define the correlation between structure of foliage and of rhizomes, if there really be any. We remember, for instance, that even if the bulb usually develops narrow and entire leaves, as in the Monocotyledones, the bulb in *Dicentra* produces dissected leaves, and the same occurs in *Saxifraga cernua*, in *Dentaria bulbifera*, etc. The horizontally creeping rhizomes produce aerial shoots and leaves of great diversity, if we compare, for instance, *Podophyllum*, *Sanguinaria*, *Iris*, *Medeola*, and numerous others.

Biologic types are, of course, represented by *Cryptogames*, as well as *Phanerogames*, but those of the latter are the most interesting, since they are more polymorphic. Among the aquatics floating and submersed species exhibit several distinct types of peculiar habit, well exemplified by *Lemna*, *Phyllospadix*, *Potamogeton*, *Brasenia*, etc.; the terrestrial, however, are much richer in types. Among these we meet with *Parasites* and *Saprophytes* of various habit, and many of the former resemble the *Autophytes*. They comprise herbs as well as shrubs, and even twiners, the herbaceous *Comandra*, the shrubby *Phoradendron*, *Arceuthobium*, etc., and the climbing *Cuscuta;* but such types as the *Lennoaceæ* and *Orobancheæ* are evidently peculiar to the *Parasites* and *Saprophytes* (*Monotropa*, *Pterospora*, *Sarcodes*,

etc.), on account of the much reduced foliar organs. The terrestrial Autophytes contain a number of characteristic types, especially the herbaceous. Of great importance to the classification of these is the structure of the subterranean organs, beside that the aerial shoot may also offer some points of interest; for instance, among the climbers.

In passing to present some brief illustrations of the occurrence of distinct structures possessed by various genera, we might begin with the *Convolvulaceæ*. In this family we meet with some species, which although closely related, nevertheless exhibit marked deviations from a biologic point of view. A twining habit has been acquired by some of these, but others are merely creeping, trailing, or simply ascending to erect, and some are shrubby. Some are annuals, others perennials by root-shoots, creeping rhizomes, or by the huge development of the primary root; beside, sometimes, by the free development of tuberous secondary roots. In the shrubby species the basal portions of the branches are lignescent. These types are thus represented within a very small family, and within species that are sometimes closely related to each other. In the genus *Ipomœa* we notice in the species *I. Quamoclit* a foliage very different from that of the family in general, since the leaves are pinnately parted into almost capillary divisions, resembling the submersed of *Batrachium*, and the aerial of *Cosmos*, *Coreopsis*, *Discopleura*, etc. We notice the extensively creeping and freely rooting aerial stem of *I. acetosæfolia ;* the trailing and sometimes twining, but not rooting, stem of *I. panâurata;* the erect or ascending stems with the slender branches recurving in *I. leptophylla*, and its narrow, linear leaves ; most of the other species are twining. In regard to the root-system, we observe in the last two species a persisting primary root, so immense that the weight aggregates to nearly a hundred pounds; furthermore, in *I. leptophylla* some of the thin lateral roots produce root-shoots. Among the species of *Convolvulus* we notice in *C. spithamæus* the aerial stems to be very short and erect, and never twining. In spite of the fact that the shoots develop very large flowers, I have never succeeded in finding any fruit,

and the very numerous plants I have examined proved invariably to be root-shoots. In *C. Soldanella* the stems are creeping; in *C. sepium* they are twining, and these species possess creeping rhizomes. Then there is a Californian species, *C. longipes*, in which the stems are erect, much branched, but feebly twining. To these may be added the shrubby *Evolvulus*, and the creeping *Dichondra*, the former one producing abundantly root-shoots.

We have thus in this family representatives of very distinct habit, depending upon the structure of the foliage, of the stem above ground, of the further development of the primary root, and finally upon the ability to produce root-shoots. It is not difficult, however, to bring these structures in correlation with the environment: *Convolvulus spithamæus* and *Ipomœa panâurata* are inhabitants of open, dry fields; *C. longipes* grows in the arid desert region of Sierra Nevada and California; *I. acetosæfolia* on the sandy sea-coast, and, finally, *Evolvulus* and *I. leptophylla* are frequent on the alkaline plains of Colorado.

In the large family *Cruciferæ*, with nearly two hundred genera, and with about two thousand species, these do not represent but a relatively small number of biologic types. They are annual, biennial or perennial herbs, very seldom suffrutescent. Many are Alpine and Arctic, and these are mostly perennial, with overwintering rosettes of leaves, and with a persisting primary root, which in *Parrya* attains a great length and a considerable thickness; succulent stems and leaves are characteristic of *Cakile* and *Crambe* from the sea-shore; a few species are aquatic, submersed (*Subularia*), or floating (*Nasturtium*).

The genus *Arabis* offers a good illustration of the annual, biennial and perennial type; *A. lyrata*, which is typically perennial, with a strong primary root, and numerous leafy rosettes, occurs, also, as an annual or biennial. Very interesting is the Arctic and Alpine *A. alpina*, which develops several prostrate shoots from the axils of the basal leaves, and these shoots are terminated by a rosette of leaves, which in the following year

sends up a flowering stem, and several horizontal vegetative shoots; although Arctic and Alpine, the organs of vegetative reproduction are in this species wholly above ground, not subterranean. In *A. dentata* the ramification is monopodial; the apex of the stem produces only a rosette of leaves for several years, from the axils of which numerous ascending flower-bearing stems arise in the early spring. Some peculiar types are represented by species of *Dentaria*; in these the rhizome is more or less tuberous, and creeping. In *D. diphylla* and *D. bulbifera* the rhizomes are prominently toothed from the fleshy, rudimentary leaves, and not jointed; but in *D. glandulosa* the growth of the rhizome is very different, since at regular intervals very long and slender internodes occur between the much shorter tuberous portions. Tuberous, but not toothed rhizomes, are possessed by *D. laciniata*, *D. heterophylla*, and *D. tenella*, and in these the rhizomes are distinctly jointed. As indicated by the specific name, *D. bulbifera* develops, also, bulblets, which appear in the axils of the small cauline leaves, beneath the flower-bearing portion of the stem; these bulblets fall off, and give rise to new individuals. In *D. tenella* no bulblets develop, but small hairy tubers appear on the long, subterranean petiole of the basal leaves; they occur generally several on each petiole, but in some distance from each other, and they are scabrous from short, stiff hairs, like the main rhizome. We have, thus, in *Dentaria* tuberous rhizomes of quite distinct structures, beside tuberiferous leaves, and bulbiferous stems. The basal leaves of *D. tenella* are typically simple, round cordate, while in some specimens a few trifoliolate leaves were observed, and these bore no tubers. Notwithstanding the development of these secondary tubers and bulblets, *D. tenella* and *D. bulbifera* do produce mature fruits with seeds, but it is said about *D. diphylla*, that it hardly ever matures the fruit. In the closely-related genus *Cardamine*, we meet with annual, biennial and perennial species, and among the last are some which show about the same structure of the rhizome as *Dentaria*; for instance, *C. rhomboidea*, *C. cordifolia*, etc. Much richer in types is the very small family *Portulaceæ*.

Portulaca oleracea is an annual, with a thin primary root ; *P. pilosa* is, also, an annual, but in this the primary root develops as a long, thick taproot for the storage of water, the species being an inhabitant of sandy, open ground in the warmer portions of this country, Florida, Arizona, Texas, etc.

Very large, napiform roots (the primary) are, also, characteristic of several species of *Talinum*, of *Lewisia*, *Calandrinia*, etc. The monotypic *Montia* is a small, procumbent annual, growing in wet places. Finally, in *Claytonia* we meet with annual and perennial species of very distinct habit. Among the annuals are *C. diffusa*, *C. Sibirica*, *C. perfoliata*, etc.; most of the others are perennial, and in these we observe the enormous development of the primary root in *C. megarrhiza*, while in *C. Virginica* the root develops merely as a roundish tuber. In *C. asarifolia* there is a horizontally creeping and fleshy rhizome ; in *C. sarmentosa* the main root persists, but is rather small, and from the axils of the basal leaves several horizontal but aerial stolons become developed. Stolons occur, also, in *C. Chamissonis*, but these are subterranean and tuberiferous at the apex. *C. parvifolia* differs from these by producing bulblets in the axils of the cauline leaves, which fall off and give rise to new individuals. There is, thus, in *Claytonia* a very prominent variation in respect to the development and growth of the over-wintering organs, as tuberous roots, as creeping rhizomes, as aerial or subterranean stolons; the former with an apical rosette of leaves, the latter with tubers; and, finally, the bulblets in *C. parvifolia*. Nevertheless *Claytonia* is a very natural genus.

Even among the Violets are types of quite distinct structure. We remember, for instance, the vertical, tuberous rhizome of *Viola pedatifida*, in contrast with the horizontally creeping of *V. papilionacea*, *V. affinis*, etc. ; the sympodial pseudo-rhizome of the caulescent *V. Canadensis*, the strongly stoloniferous of *V. blanda*, *V. primulæfolia*, etc., and several of these species occur in the same soil associated with each other. Finally, there is a bulbous species in Siberia, and some that are suffrutescent in South America. However, few genera are

so rich in biologic types as Saxifraga. Annual, biennial, perennial herbs and suffrutescent are known from this genus, and the methods of vegetative reproduction are manifold, accompanied by extreme variation in foliage as to outline and structure; it seems, indeed, difficult to find a genus more amply equipped in this respect than *Saxifraga*. The species abound in the mountains at high elevations, and are, furthermore, well represented in the polar regions ; only a very few species are characteristic of the lowlands. It is, therefore, a genus of special interest from a geographical point of view, and at the same time it offers an excellent illustration of the methods and means by which these little plants are able to subsist at stations where the climatologic conditions are extremely unfavorable to most other plants. The Arctic *S. tricuspidata*, and the Alpine *S. bronchialis*, are suffrutescent, with woody, partly subterranean stem, upon which many ascending shoots are developed, with crowded leaves ; *S. chrysantha*, shows the same habit, but the leaves are coriaceous, and evergreen. In *S. punctata* there is a creeping rhizome with strong roots, a rosette of ample leaves, and a tall, naked stem with an open paniculate inflorescence. A short subterranean stem, crowned with a densely-leaved rosette, occurs in many species ; for instance, *S. nivalis*, *S. hieraciifolia*, etc. *S. cernua* has a small bulb, beside that many of the flowers are transformed into similar bulblets, which drop off and develop new individuals. In the Arctic regions *S. stellaris* occurs most frequent as the so-called variety *comosa*, in which all, or nearly all, the flowers are transformed into bulblets, the function of which is the same as in *S. cernua*. A corresponding bulbiferous variety occurs in the mountains of Spain, *S. Clusii*, var. *propaginea*, in which all the flowers are transformed into such bulblets.

One of the most interesting species is, however, *S. flagellaris*; the small, succulent leaves form a dense rosette, from the center of which a short and erect flowering stem develops. The vegetative reproduction is secured by means of relatively very long stolons above ground, which develop from the rosette, and which consist of a single internode, the apex of which becomes

terminated by a small, globular rosette of leaves. The internode dies off during the first season, and each rosette, which soon roots, gives rise to new plants in some distance from the mother-individual; a similar structure is to be observed in *S. Aizoon*. A very different habit is possessed by *S. oppositifolia*; in this the numerous stems are prostrate, and produce an abundance of flowers and leaves. It is, thus, interesting to notice that such remarkably distinct biologic types may be represented in a single genus, and that several of these are characteristic of species which mostly occur associated with each other in the Arctic and Alpine regions.

Among the *Caryophyllaceæ* we notice a few, but quite interesting types in the genus *Stellaria*. In regard to the method of vegetative reproduction, we notice in *S. pubera* the development of large, mostly purely vegetative shoots, which appear a little later than the floral, and which persist through the winter prostrate on the ground, rooting at the nodes, and thus remaining active during the winter months; these shoots produce in the following spring axillary buds, which soon grow out into floral or similarly vegetative branches. The high Alpine *S. umbellata* winters over, and persists by means of buds formed in the axils of the cauline, aerial leaves, beside by subterranean shoots, with fleshy, imbricate leaves. In *S. Jamesii* there is a distinct tuberous, moniliform rhizome with scale-like leaves, and rooting freely at the nodes. The Arctic and Alpine *S. longipes* winters over by means of buds like *S. umbellata*, beside that it possesses, also, a slender rhizome with long stolons, bearing small, scale-like leaves. This same structure recurs in *S. longifolia*, *S. humifusa*, *S. Holostea*, and *S. crassifolia*. Subterranean stolons occur, furthermore, in *S. borealis* and *S. crispa*, but in these the aerial stems do not appear to persist through the winter, thus no hibernating buds are developed.

When looking through the *Umbelliferæ*, with one hundred and fifty genera, and about thirteen hundred species, it is surprising to see how uniformly most of these are developed, although they are mainly herbaceous. The points characteristic of a biologic type are here mostly exhibited by a persisting

primary, or by several persisting secondary roots, while rhizomes are seldom met with. Creeping rhizomes are possessed by *Sium lineare*, and by *Aegopodium*, for instance, but tuberiferous stolons are extremely rare, and so far as I know, such occur only in *Hydrocotyle Americana*. In the genus *Cicuta*, one species, *C. bulbifera*, has several of the axillary shoots above ground transformed into roundish tubers, which drop off and develop new individuals; fruits are said to be rarely developed in this species.

If we now examine such plants which depend more or less on the development of root-shoots, we observe this method of reproduction well exemplified in various members of the genus *Pyrola*, in *Chimaphila*, in *Rhexia* of the *Melastomaceæ*, in *Cirsium arvense*, *Linaria*, *Thesium*, *Epilobium*, etc., but it is very seldom that plants are depending on this kind of vegetative reproduction only; but it is certainly the case with *Pyrola uniflora*, *Rhexia*, *Cirsium arvense*, and a few others.

Now, in respect to the *Monocotyledones*, there are very many characteristic types represented by our terrestrial and epiphytic Orchideæ; some with large tuberous roots, *Platanthera, Orchis,* and *Spiranthes*, for instance; others with tuberous rhizomes, as *Aplectrum*, *Calypso*, *Tipularia*, *Liparis*, etc.; or the coralloid destitute of roots in *Corallorhiza* and *Hexalectris*. In the *Liliaceæ* we notice the bulbs as especially characteristic of *Lilium, Allium*, *Erythronium*, etc., while we find tuberous rhizomes in *Smilax*, *Trillium*, *Chamælirium*, *Smilacina*, etc. Tuberiferous stolons occur in *Lophiola*, *Sagittaria*, *Medeola*, and in *Cyperus phymatodes*.

It is remarkable to see the sharp distinction between some of these biologic types, and the gradual transition from one to another in others. Moreover, the occurrence of certain very distinct types within the same genus, and the occurrence of these in the same soil, often associated with each other. It is, also, strange to think of that these structures are constant, constant to the species in which they occur in nature, and that only some few of these may be changed by artificial cultures.

Some of these structures are purely specific, others generic; some may be regarded as epharmonic, while many are, undoubtedly, simply inherited from ancestral types. The commingling of biologic types at the same stations, and in the same soil, may be due to the varied equipment of the species, or to violent disturbances in the natural surroundings. When the forests fall, by the axe or the fire, the vegetation necessarily changes. The sciaphilous types succumb entirely, or they become forced into a dormant existence as seeds or rhizomes waiting for more favorable conditions to return. But some of the sylvan types are strong enough to persist, and these we find commingled with the newcomers, photophilous species. Then when the forest revives the latter types mostly disappear, but not all. Thus when the old conditions have finally returned the sciaphilous species become the predominant, but mixed with the others, hence we might meet with a vegetation of types, utterly unlike each other from a biologic point of view.

The Geoglossaceæ or Earth-tongues.

BY ELIAS J. DURAND.

The writer has recently completed a monograph of the Geoglossaceæ of North America, which will appear in a forthcoming number of the Annales Mycologici. It has occurred to him that your readers might be interested in some brief notes on these plants. Most persons who frequent the woods during August and September have met with specimens of this interesting group of fungi. The family is a small one, although quite characteristic, only 11 genera and 45 species and varieties being found up to the present time in North America. The majority of the species are club-shaped or clavate in outline, with a general resemblance to some species of Clavaria, and being usually somewhat flattened or compressed bear a fancied likeness to the slender tongue of some animal, hence the name popularly applied to them. The spores are borne in narrow, nearly cylindrical sacks, called asci, which arise at right

angles to the long axis of the plant, and along with certain sterile threads or paraphyses form a compact layer or stratum, known as the hymenium, covering the surface of the upper end. This ascigerous portion is commonly rather sharply delimited from the stem below.

About half of the clavate forms are black, or nearly so. One genus of these (Trichoglossum) has the whole surface of the stem, as well as the hymenium, beset with long, black, needle-shaped spines or cystidia, which cause the whole plant to appear velvety. The species of this genus occur on soil or humus in rich woods. The spores are long, nearly cylindrical, and many septate. Among the black forms without spines a few are distinctly viscid or gelatinous, but the majority (species of Geoglossum) are fleshy. *Geoglossum glabrum* is one of the commonest forms which grows on rotten logs or stumps, or much decayed rotten wood. It is slender, black, and sometimes more than four inches long. The spores are clavate, brown, and 7-septate. A few rare forms belonging to the genus Corynetes have the aspect of Geoglossum, but differ in having hyaline spores.

Of the bright colored, clavate forms, the species of Spathularia are most easily recognized, being much compressed and spathulate or fan-shaped in outline. They are to be found most abundantly under coniferous trees growing among the needles. The genus Mitrula has several interesting species. *M. phalloides* is one of the few species to appear in early summer, maturing in May or June. The stem is slender and satiny white, while the hymenium is egg-yellow. It grows on wet leaves or sphagnum, in very wet bogs, pools or ditches. *Mitrula cucullata* is a diminutive form, growing always on dead coniferous leaves. *M. muscicola* and *M. gracilis* are parasitic, on living moss. The former has been reported in America only from Alberta, and the latter from Greenland, Labrador and Newfoundland. Both should be found in Ontario. A fifth species, *M. irregularis*, occurs abundantly under conifers in many parts of Ontario. It has a white stem and egg-yellow

head, and is very irregular or polymorphic in form. Dr. Faull reports it as common in the Algonquin Park and Temagami Forest Reserve.

Two species of Microglossum are noteworthy, on account of their beauty. *M. rufum* is not uncommon, on rotten wood around stumps. The hymenium is egg-yellow, but the stem is paler and squamose. *M. viride* has every part pea-green, and the stem squamose. It grows on clay or loamy soil along wood roads. Both are 1 to 3 inches high.

About one-quarter of the species of the family are pileate rather than clavate in form. In these the ascigerous portion is horizontal at the summit of the stem, the upper or superior surface being ascigerous, while the lower or inferior one is sterile. The commonest representatives of this type are found in the genus Leotia, in which all the species are gelatinous or subgelatinous in consistency. *L. lubrica* is probably the most abundant member of the family, often occurring in considerable quantities. Its ordinary color is yellowish ochraceous, but varies to greenish or olive. It grows on the ground, and varies exceedingly with the character of the substratum and the amount of moisture supplied to it. *L. stipitata* is similar in habit, but has a white or yellowish stem and deep verdegris-green hymenium.

A second genus with the pileate form is Cudonia, with a fleshy-leathery consistency and clavate-filiform spores. The commoner species northward is *C. circinans*. This grows most abundantly under conifers among the needles. It varies in color from rosy cream-buff to yellowish or brownish. It is 1 to 3 inches high. *C. lutea* is similar in form and size, but is pale yellow to buff in color. I have found it most often on dead leaves in beech thickets.

Vibrissea truncorum is peculiar in having very long hair-like spores, and in being truly aquatic. The plants grow on wood or on sticks which are wholly or partly submerged, and reach their best development under water. The stem is commonly brownish, and the hymenium yellow to orange.

In the preparation of the monograph above mentioned the writer has examined specimens of the following species from British America. All of these, and several others, should be found in Ontario, and he would be very glad at any time to examine and report on specimens which any one might care to submit to him.

Mitrula irregularis.
" *phalloides.*
" *gracilis.*
" *muscicola.*
Microglossum rufum.
" *olivaceum.*
Corynetes arenarius.
Geoglossum glutinosum.
" *difforme.*
Geoglossum glabrum.
" *intermedium.*
Trichoglossum hirsutum.
Spathularia clavata.
Leotia lubrica.
Vibrissea truncorum.
Cudonia circinans.
" *lutea.*

Botanical Department, Cornell University.

Notes on Some Birds of Bruce Co., Ontario.

BY A. B. KLUGH.

The spring migration at Colpoy's Bay, Bruce Co., Ontario, was this spring (1908) marked by the absence of large waves and by the scarcity of some species usually common, as the Olive-backed Thrush, Nashville Warbler, Palm Warbler, and Canadian Warbler. But compensation was made by the comparative abundance of the Orange-crowned Warbler, which I had not previously taken in Bruce Co., and which was noted this spring on May 12, 13, 16, 18 and 19, and also by the capture on May 17 of a male Prairie Warbler, one of the rarest of Ontario Warblers.

The Blackpoll Warbler, which is scarce in spring in most parts of the Province, was abundant on May 23 and common on May 24 and 25.

The Cape May Warbler is certainly becoming commoner in Ontario. Some years ago it was regarded as one of our

rarest Warblers, and in all his years of collecting, Mr. McIlwraith took only six. In 1905 I noticed an increase in their numbers at Guelph, and found them to be common during one day at Point Pelee, Essex Co. This year, in Bruce Co., I took 8, and positively identified 3 more.

The fall migration was like the spring, devoid of large waves, but the number of individuals was larger than in the spring.

Tennessee Warblers, which were absent during the spring, were common, and another Orange-crown was taken on Sept. 21. On August 10, at Red Bay, on the Lake Huron shore, I took a young Myrtle Warbler, in the *juvenal* plumage, and at the same place, on Sept. 5, I ran across an immense flock of Golden-crowned Kinglets, most of which were young, in the *juvenal* plumage.

This fall I noticed the same peculiar migration of Nighthawks which I had observed in the fall of 1905. About 3 p.m. they appeared in vast numbers, numbers sailing along over the shore of Colpoy's Bay. They did not go out over the water more than a hundred yards, nor inland more than five hundred yards. Each individual kept on circling, each turn taking it further south. In this way they continued to pass for about two hours, and after that no more Nighthawks were seen.

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The Ericaceæ and Orchidaceæ in the Vicinity of Galt, Ontario.

BY W. HERRIOT.

Perhaps of all our flowering plants no two orders can compare with the Heaths and Orchids for the beauty and delicacy of their blossoms.

From the exquisite mountain heaths 'midst the Alpine solitudes of the Rockies to the much-prized mayflower and lady's-slippers of our eastern woods and glens, there are hidden away

in sphagnum bog and shaded ravine many a floral gem seldom seen except by the ardent botanist.

Back from the valley of the Grand River, on both sides a chain of lakes and bogs extend all the way from Galt to Paris, surrounded often by extensive stretches of tamarack swamp, exceedingly rich in species of these two orders. All of the species here enumerated were collected within a radius of ten miles from Galt. The arrangement and nomenclature is according to Gray's new Manual of Botany, seventh edition.

ERICACEÆ.

Chimaphila umbellata, (L.) Nutt. — (Prince's Pine.) Dry woods. Common.

Moneses uniflora, (L.) Gray.—(One-flowered Pyrola.) Deep, rich or dry woods. Frequent.

Pyrola secunda, L.—(One-sided Pyrola.) Rich or dry woods. Common.

Pyrola secunda, var. *obtusata*, Turcz.—Cold cedar swamps. Found at two stations. Plentiful.

Pyrola chlorantha, Sw.—(Greenish-flowered Pyrola.) Dry woods. Infrequent.

Pyrola elliptica, Nutt.—(Shin Leaf.) Dry or rich woods. Common.

Pyrola americana, Sweet.—(Round-leaved Pyrola.) Dry or rich woods. Common. Distinct from P. rotundifolia, L., of Europe.

Pyrola asarifolia, var. *incarnata*, (Fisch). — (Bog Pyrola.) Mossy woods and bogs. Common.

Monotropa uniflora, L.—(Indian Pipe.) Deep, rich woods. Common.

Monotropa Hypopitys, L.—(Pinesap.) Rich woods. Rare.

Ledum grœnlandicum, Oeder.—(Labrador Tea.) Swamps and bogs. Frequent.

Kalmia polifolia, Wang.—(Pale Laurel.) Sphagnum bogs. Frequent.

Andromeda glaucophylla, Link.—(Bog Rosemary.) Bogs. Frequent. Distinct from A. polifolia, L., of a more northern range.

Chamaedaphne calyculata, (L.) Moench. — (Leather Leaf.) Bogs and swamps. Common.

Epigaea repens, L.—(Mayflower.) In all references to this beautiful plant I have seen, the habitat is given as sandy or rocky woods, under evergreens. Wherever I have seen it in this locality it has been in cold cedar swamps, with Ledum groenlandicum, but growing on hummocks or rotten logs, and elevated spots, which in spring are difficult to reach when the swamps are inundated. Found at three stations, and abundant in a large swamp where Dalibarda repens is an immediate associate.

Gaultheria procumbens, L.—(Common Wintergreen.) Dry woods, clearings and swamps. Common.

Arctostaphylos Uva-ursi, (L.) Spreng.—(Bearberry.) Growing in patches at a few stations.

Chiogenes hispidula, (L.) T. &. G.—(Creeping Snowberry.) Mossy bogs and cedar swamps. Common.

Gaylussacia baccata, (Wang.) C. Koch. — (Black Huckleberry.) Common. In swamps, and sometimes on drier uplands.

Vaccinium pennsylvanicum, Lam.—(Low Blueberry.) Dry woods and clearings. Common.

Var. nigrum, Wood.—With the type. Somewhat rare.

Vaccinium canadense, Kalm.—(Velvet-leaf Blueberry.) Low woods and swamps. Frequent.

Vaccinium vacillans, Kalm.—(Late, low Blueberry.) Dry woods. Rare.

Vaccinium corymbosum, L.—(High Blueberry.) Swamps and sphagnum bogs. Frequent.

Var. amoenum, (Ait) Gray.—With the type. Occasional.

Vaccinium atrococcum, (Gray) Heller. — (Black, high Blueberry.) Swamps and bogs. Frequent.

Vaccinium Oxycoccus, L.—(Small Cranberry.) Sphagnum bogs. Common.

Vaccinium macrocarpon, Ait. — (Large Cranberry.) Sphagnum bogs and marshes. Common.

ORCHIDACEÆ.

Cypripedium parviflorum, Salisb. — (Small Yellow Lady's Slipper.) Cedar swamps. Becoming rare.

Var. pubescens, Willd.—(Larger Yellow Lady's Slipper.) Once plentiful. Becoming rare.

Cypripedium hirsutum, Mill.—Showy Lady's Slipper.) Tamarack swamps. Plentiful at a number of stations.

Cypripedium acaule, Ait.—(Stemless Lady's Slipper.) Low woods and tamarack swamps. Becoming rare. All our Lady's Slippers, at one time plentiful, are gradually being exterminated, from the persistent uprooting of the plants by selfish collectors for the garden, a vandalism much to be deplored.

Orchis spectabilis, L.—(Showy Orchis.) Deep rich woods. Rare.

Habenaria bracteata, (Willd) R. Br.—(Long-bracted Orchis.) Rich woods. Rare.

Habenaria hyperborea, (L.) R. Br. — (Green Rein Orchis.) Bogs and low woods. Frequent.

Habenaria dilatata, (Pursh) Gray. — (White Rein Orchis.) Sphagnum bogs and swamps. Frequent.

Habenaria clavellata (Michx.) Spreng.—(Green Wood Orchis.) Bogs and wet woods. Rare.

Habenaria orbiculata, (Pursh.) Torr. — (Round-leaved Rein Orchis.) Rich woods and cedar swamps. Rare.

Habenaria lacera, (Michx.) R. Br. — (R a g g e d Orchis.) Swamps. Rare.

Habenaria psycodes, (L.) Sw.–(Purple-fringed Orchis.) Low open woods and meadows. Infrequent.

Pogonia ophioglossoides, (L.) Ker.—(Rose Pogonia.) Sphagnum bogs and marshes. Frequent.

Calopogon pulchellus, (Sw.) R. Br. — (Grass-pink.) Open swamps and bogs. Frequent.

Arethusa bulbosa, L.—(Arethusa.) Sphagnum bogs. Somewhat rare.

Spiranthes gracilis, (Bigel) Beck.–(Slender Ladies' Tresses.) Dry open woods. Rare.

Spiranthes lucida, (H. H. Eaton) Ames. — (Broad-leaved Ladies' Tresses.) Moist banks and grassy places along the Grand River. Frequent.

Spiranthes cernua, (L.) Richard.–(Nodding Ladies' Tresses.) Peat bogs and marshes. Frequent.

Spiranthes Romanzoffiana, Cham.–(Hooded Ladies' Tresses.) Bogs and marshes. Common.

Epipactis repens, var. *ophiodes*, (Fernald.) A. A. Eaton. — (Lesser Rattlesnake Plantain.) Cedar swamps. Rare.

Epipactis pubescens, (Willd.) A. A. Eaton.—(Downy Rattlesnake Plantain.) Dry or rich woods. Frequent.

Corallorhiza maculata, Raf.—(Large Coral-root.) Dry or rich woods. Frequent.

Corallorhiza trifida, Chatalein.—(Early Coral-root.) Low woods and cedar swamps. Rare.

Microstylis monophyllos, (L.) Lindl.—(White Adder's-mouth.) Moist woods. Rare.

Liparis Loeselii, (L.) Richard.—(Tway-blade.) Bogs and springy places. Frequent.

Aplectrum hyemale, (Muhl.) Torr. (Putty-root.) Rich woods. Rare.

Galt, January 2nd, 1909.

The Influence of Darwin on Botanical Science.

BY J. H. FAULL.

The foundations of Botanical science had been well laid prior to the time of Darwin. The story of the founding goes back to the classical period, to Theophrastus, Pliny, and Dioscorides, whose writings were mainly inaccurate descriptions of medicinal herbs, and philosophical dissertations on plants real or imaginary.

The next chapter opens on the sixteenth century, when, under the influence of the renaissance on the medical profession, plants were for the first time scientifically studied. The physicians of the renaissance period had been unable to recognize the forms—medicinal or any other kind recorded by the classical authors, and as there were no others to whom to turn, they began to study the vegetable kingdom on their own account. A clearing had first to be made in the unexplored jungle, and, hence, all the good work of the early botanists or herbalists consisted in figuring and describing plants. As might be surmised, their attempts towards formulating a system of classification were exceedingly crude; the assembling and arranging the materials gathered by the herbalists of the sixteenth century into anything approximating to natural groups was a sufficient task to occupy all the powers of the botanists of the succeeding two hundred years.

The elaboration of a natural system was a long and painful process. It began with the division of plants into trees and herbs in 1583, by the philosophical Cesalpino, chief physician to Pope Clement VIII., and was only finally made possible by the adoption of the Linnean binary system of nomenclature, and Pyrame de Candolle's classification—a classification based on a comparative study of the form and development of the organs of plants, irrespective of their functions. Thus, the results of the labors of two centuries was a natural system, characterized by an unsurpassed nomenclature, and approximating to the one in vogue at the present day. But natural as was their

system, it had been intuitively evolved, and except for the uneasiness that may have existed in the minds of the plant anatomists, no one for a moment entertained belief in any other than the dogma of special creation and fixity of species. Each species was a platonic idea expressed at some time or other by the creator, and not linked to any others by intergrading or connecting forms.

But two fields of investigation were now opened that prepared the way for the teachings of Charles Darwin, namely, plant geography and plant histology.

Pre-eminent among the plant geographers stands the name of Alphonse De Candolle. Transitional forms were forced upon De Candolle's attention as he traced the vegetation from formation to formation, and from valley to valley, over the Arctic heights of his native Alps, and in spite of his orthodoxy he was bound to declare in his classic "Geographic Botanique Raisonnée" of 1853, that " he surmised that, notwithstanding the general stability of forms, certain species, or quasi-species, might have originated through diversification under geographical isolation." Thus, not only did he suspect that plants were distributed according to definite laws, but that some cause was responsible for adaptive variations in types occupying different habitats.

But, before De Candolle had completed his studies, the corner-stone of the science had been laid. It had been well and truly done by Schleiden and Schwann, in the enunciation of the cell theory in 1838-9, a biological generalization, of which it may be said that "no other, save only the theory of organic evolution, has brought so many, apparently diverse phenomena, under a common point of view, or has accomplished more for the unification of knowledge." It was more than a theory; it was a statement of the fact that every organism is built up of cells, the product of the repeated divisions of the single egg cell that initiated the existence of the organism. Through the cell-theory, as Wilson affirms, "Nägeli and Hofmeister opened the

way to an understanding of the nature of embryological development, and the law of genetic continuity lying at the basis of heredity." Hofmeister, in particular, exercised a deep influence on the philosophical conceptions of his day. His brilliant studies in plant Embryology, published in 1851, shook the very foundations of the strongholds of the special creationists. Thus did plant geography and histology and its offspring embryology pave the way for the acceptance of the Darwinian hypothesis. In fact, so clear were the evidences of transitional forms adduced by De Candolle, so undoubted the fact discovered by Schleiden and Schwann that the cell is the unit of structure, so remarkable the resemblances Hofmeister found to exist among embryos belonging to even widely-separated groups that botanists, while still held to the traditions of the past, were now haunted by the futility of trying to fix limits to the vagaries of a species, and by the inexplicable meaning of the fundamental unity of structure and parallelism in development pervading the organic world.

The wisest sought refuge in the term *affinity*, but took pains to assert that they were using it only in a figurative sense.

At this juncture, in 1858-59, appeared Darwin's Origin of Species, and the famous essay of that self-abnegating scientist whose name will ever be coupled with that of Darwin—Alfred Russell Wallace.

Darwin's hearers were more receptive than he expected to find them, for his views outside of France received instant acceptance among the majority of militant botanists. Hooker, Director of Kew Gardens, assisted by the Geologist Lyell, fathered the book while yet in manuscript; Asa Gray, the leading American Botanist of his time, begged to read the printed sheets as they issued from the press, and De Candolle at once began to organize his investigations along the new lines. In fact, the foundations of botanical science had been so deeply and broadly laid, and Darwin had so sympathetically and intelligently grasped their lines, that the botanical builders of

fifty years ago, stirred as they were by dimly apprehended perceptions of like kind, were ready to accept the plans drawn up by the master architect as worthy of a far-reaching application in the development of a superstructure that might fittingly rest thereon.

At once Darwinism began to influence every phase of botanical science, for the principles involved were fundamental and the time was ripe for their understanding.

The natural system—formerly an Empirical formula—now, without change of form, became a genealogical tree of blood relations. Clarity reigned instead of obscurity. The spectre of the species concept forever vanished as the conviction of variation made its presence felt. The systematist was again brought into harmony with his fellows, and was led to see that he might derive aid from his co-laborers in other fields in the work of perfecting the natural system. In a word, there was a shaking up of dry bones in the taxonomic world, a fitting together of joints, a clothing on with flesh, an inspiration of life, and the new birth of co-operative fellowship.

Morphology received an impetus that has not yet spent itself. Homology, as a morphological term, took on its true meaning; vestigial and rudimentary organs became clear, and have since served as the starting points of numerous significant investigations. The flowerless plants were the first to be attacked, and under the guidance of Dr. Bary, chaos was soon replaced by order. The uncovering of new principles at the base of the vegetable kingdom in turn led to new investigations on the higher plants, resulting in many notable discoveries, one of the most striking of which was the elucidation of the sexual processes in the flowering plants. It is further to be recorded that with every improvement in the microscope the firmament of the plant world is swept from horizon to horizon, but penetrate as far as we may, the evolutionary principle receives additional proof, and used as a working hypothesis it serves as a sure and stimulating guide.

In tracing homologous organs from group to group, especially in the case of the great divisions of the woody plants, the

search for missing links has been carried back to the vegetation of bygone ages as preserved in the rocks, and of late a wonderful activity has been displayed in Palaeobotany. Here, too, rich finds have been made; phyla wholly extinct have been discovered and fitted into their niche in the general scheme, and the course of evolution in surviving phyla clearly demonstrated in more than one instance.

Plant Geography and Vegetable Physiology were also made to feel the far-reaching influence of the theory of evolution. The former was championed by De Candolle, and an application of Darwinism in the latter was exemplified by several important investigations, two of which, carried out by Darwin himself, I venture to cite by way of illustration. One of these, the last fruit of the labors of his hands, was on "The Power of Movement in Plants." His attention had been drawn to this subject from the circumstance that climbing plants belong to very diverse families, for there are climbing ferns, climbing legumes, climbing lilies, and so on; and, further, that in each case the climbing organ describes similar sweeping circular movements through space. He argued that if there exist a blood relationship among plants, as his theory of descent claimed, these rotary movements may be expected to occur in the growing parts of all plants, weak in most cases, but capable of high specialization under the selective influence in any group if of advantage in the struggle for existence. Experiments with suitable apparatus demonstrated the absolute correctness of his deduction.

The second and more important investigation was on the "Fertilization of Orchids by Insects." The attempt was made to explain the secrets of the flower — the causes of its color, nectar glands, and nice diversities of form on the basis of adaptation to insect pollination. The orchids were particularly well suited to his purpose, for their flowers display endless details of structure, and after many months of patient observation he established his case. Sprengel, the greatest of nature students in this field, was laughed out of court, when, in 1793, he made a similar suggestion with regard to color, but Darwin,

backed by his newly-expounded doctrine, readily enforced conviction. He proved that the mechanism of the flowers of most orchids renders self-fertilization impossible ; that the nectar glands are so placed and the flower so ordered as to not only bring the insect visitor into contact with the essential organs at the critical points, but also to allow only the chosen species of insect to profit by its visits. This work has been estimated to rank next in importance to " the Origin of Species"; its value as a creative work is proved by the fact that between the issuing of the first and the second editions of this book nearly 900 papers had appeared on the subject.

It is enigmatic that in the remaining field, the experimental, the very one in which Darwin had won his greatest triumph, there should have been, with one shining exception, perfect inaction. Contrary to what might have been expected, the only investigation into the factors of evolution, worthy of mention, up to the beginning of the present decade, was that on hybridization, carried on by Gregor Mendel in his cloister garden at Brümn in 1865, the record of which has been so lately unearthed. A flourishing school of experimental botany has, however, at last taken root, a pleasing respite from the theorizings *ad nauseam* on this subject for the last fifty years. Led by De Vries on the side of pure science, and focusing on sporting characters (saltations or mutations), which are known to be transmissible, and working on hybridization, the experimentalists have proved that new species may come into existence under our very eyes; more significant still, that their production may to some extent be influenced by our own intelligent efforts.

Led by Nilsson, of Sweden, and Hays, of Minnesota, in the domain of applied botany, it is being tangibly demonstrated to the wayfaring man that a knowledge of the principles of evolution in the light of recent discoveries will help, if properly applied, to raise more corn and more wheat to the acre, and bread and meat of better quality. In fact, the new doctrine has been extended to agriculture, horticulture and arboriculture, and has

there given birth to the very modern science of plant-breeding. Here is an engrossing and illimitable field.

But so might I say of every phase of human learning. "The known is finite," says Huxley; "the unknown infinite." Standing each in his own little clearing, looking to the East and to the West, to the North and to the South, we perceive a vast unexplored territory all about us. One here and one there has made his clearing on an eminence somewhat higher than those of his fellows, and so has the wider outlook, but few on a level with the height attained by Darwin. Fortunately, Darwin charted the prospect that unfolded before him, and so wide was his outlook, and clear his vision, that with this chart in hand workers in every field of Science have been invigorated and directed in their efforts to wrest something more from the great unknown. Indeed, I doubt not that Huxley spoke truly, at least for botanical science, when he asserted that the most potent instrument for the extension of the realm of natural knowledge which has come into men's hands since the publication of Newton's Principia, is Darwin's Origin of Species.

Birds of Orangeville, Ontario, and Vicinity.

BY E. W. CALVERT.

The Town of Orangeville is situated on the southern boundary of Dufferin County, and is a few miles south of the Height of Land in the Western Peninsula. The country within a few miles of the town is rather variable, and is composed of flat, swampy land, and also of rough, hilly country, the latter being in the neighborhood of the large streams.

These streams, of which there are several, are of two kinds. The first kind is a sluggish, winding stream, with very little fall to it, and is bordered by swamp land; the other is a rapid stream, flowing between high banks. Each of these conditions forms attractions for many Land Birds and a few Water Birds, which would otherwise be absent.

In addition to the streams there are some twenty small lakes and ponds, containing from one to 125 acres. The most important of these are Caledon Lake, Mud Lake, Melville Mill-pond, Island's Lake and Maxwell's Lake. The first two named are surrounded by extensive swamps. These lakes attract ducks and other Water Birds in large numbers.

In preparing this list, the writer has found it impossible to examine all the species which have been found in this district. It was, therefore, thought advisable to place those species, which have been observed by friends who have paid considerable attention to the study of birds, in a separate list. These species should not be used as records for this locality, however, if quotations are made.

The writer wishes to thank Messrs. Wm. and Nelson Phillips, of Amaranth Township; Mr. F. G. Porter, of town, and Messrs. C. McFayden, George Maxwell and A. J. Scott, of Caledon Township, for notes furnished.

All the species enumerated have been found within a radius of twelve miles of the town.

I.—SPECIES UNDER PERSONAL EXAMINATION.

1. Holboell Grebe.—Scarce; migrant. An immature bird, caught in a snowdrift, Feb. 8, 1908.

2. Horned Grebe.—Scarce; migrant.

3. Pied-billed Grebe.—Scarce; migrant.

4. Loon.—Frequent; migrant.

5. Am. Herring Gull.—Frequent; migrant.

6. Bonaparte Gull.—One taken at Maxwell's Lake.

7. Double-crested Cormorant.—One taken at Caledon Lake in November, 1894.

8. Am. Merganser.—Frequent, or sometimes common; migrant.

9. Hooded Merganser.—Frequent; migrant. Said to breed in Amaranth.

10. Mallard.—Scarce; migrant. Said to breed.

11. Black Duck.—Common; migrant; scarce; summer resident.

12. Wood Duck.—Scarce. Probably breeds. Abundant 25 years ago.

13. Lesser Scaup Duck.—Common; migrant.

14. Am. Goldeneye.—Scarce; migrant.

15. Buffle-head.—Common; migrant.

16. Old Squaw.—Frequent; migrant.

17. Canada Goose.—Frequent; migrant.

18. Am. Bittern.—Common; summer resident.

19. Great Blue Heron.—Common; migrant; frequent summer resident. Used to breed.

20. Black-crowned Night Heron.—One taken at Maxwell's Lake. The bird was immature.

21. Sora.—Frequent; summer resident.

22. Am. Coot.—Frequent; summer resident. Used to be more abundant.

23. Wilson Snipe.—Frequent; migrant.

24. Red-backed Sandpiper.—A wounded bird captured May 23, 1908.

25. Greater Yellow-legs.—Frequent; migrant.

26. Solitary Sandpiper.—Frequent; migrant.

27. Spotted Sandpiper.—Common; summer resident.

28. Hudsonian Curlew.—Scarce; migrant. A flock of about fifty passed over in the spring of 1907, and a pair was secured.

29. Killdeer.—Common; summer resident.

30. Ruffed Grouse.—Common; resident.

31. Passenger Pigeon.—Once abundant.

A flock of ten seen on Easter, 1899.

32. Mourning Dove.—Frequent; summer resident.

33. Marsh Hawk.—Common; migrant; and probably summer resident.

34. Sharp-shinned Hawk.—Frequent; summer resident.

35. Am. Goshawk.—Frequent; fall and winter migrant. Said to breed in Amaranth.

36. Red-tailed Hawk.—Frequent; summer resident.

37. Red-shouldered Hawk. — Frequent ; summer resident.

38. Swainson Hawk.—Rare. Taken in Amaranth in the winter.

39. Broad-winged Hawk.—Frequent; summer resident.

40. Am. Rough-legged Hawk.–Frequent fall migrant; scarce in spring.

41.—Am. Sparrow Hawk.—Common; summer resident.

42. Am. Osprey.—Frequent; migrant. Possibly a summer resident.

43. Am. Long-eared Owl.—Frequent ; summer resident in Amaranth.

44. Short-eared Owl.—Scarce; fall migrant in Amaranth.

45. Saw-whet Owl.—Scarce; resident; formerly common.

46. Screech Owl.—Frequent; resident.

47. Great Horned Owl.—Frequent; resident.

48. Snowy Owl.—Frequent; winter visitor.

49. Black-billed Cuckoo. — Frequent; summer resident.

50. Belted Kingfisher. — Common; summer resident.

51. Hairy Woodpecker.—Common ; resident.

52. Downy Woodpecker.—Common; resident.

53. Arctic Three-toed Woodpecker. Formerly frequent resident in Amaranth.

54. Yellow-bellied Sapsucker.—Common; summer resident.

55. Red-headed Woodpecker.—Common; summer resident.

56. Northern Flicker. — Common; summer resident.

57. Nighthawk.—Common; summer resident.

58. Chimney Swift. —Abundant; summer resident in town; common in country.

59. Ruby-throated Hummingbird.—Frequent; summer resident.

60. Kingbird.—Common; summer resident.

61. Crested Flycatcher.—Common; summer resident.

62. Phoebe.—Common; summer resident.

63. Olive-sided Flycatcher.—Scarce; summer resident.

64. Wood Pewee.—Common; summer resident.

65. Least Flycatcher.—Common; summer resident.

66. Prairie Horned Lark.—Common; summer resident.

67. Blue Jay.—Common; resident.

68. Am. Crow.—Abundant; summer resident; rare in winter.

69. Bobolink.—Common; summer resident.

70. Cowbird.—Common; summer resident.

71. Red-winged Blackbird.—Abundant; migrant; common summer resident.

72. Meadowlark.—Common; summer resident.

73. Baltimore Oriole.—Common; summer resident.

74. Rusty Blackbird.—Common fall and scarce spring; migrant.

75. Bronzed Grackle.—Abundant; migrant; common summer resident.

76. Evening Grosbeak.—Observed in town on Jan. 31 and Feb. 6, 1907.

77. Pine Grosbeak.—Irregular winter visitor.

78. Purple Finch.—Common; migrant; frequent summer resident.

79. White-winged Crossbill.—Irregular winter visitor. Common in winter of 1906-07.

80. Redpoll.—Frequent, or sometimes common; winter visitor.

81. Am. Goldfinch.—Common; summer resident.

82. Pine Finch.—Common; winter resident generally; often common in spring and fall.

83. Snowflake.—Common; winter visitor.

84. Vesper Sparrow.—Abundant; summer resident.

85. Savanna Sparrow.—Common; summer resident.

86. White-crowned Sparrow.—Frequent; migrant.

87. White-throated Sparrow.—Abundant migrant; common summer resident.

88. Tree Sparrow.—Common migrant; scarce winter resident.

89. Chipping Sparrow.—Abundant; summer resident.

90. Slate-colored Junco. — Abundant migrant; frequent summer resident.

91. Song Sparrow.—Abundant; summer resident.

92. Swamp Sparrow. — Common; summer resident.

93. Fox Sparrow.—Scarce or sometimes frequent; migrant.

94. Towhee. — Frequent; summer resident.

95. Rose-breasted Grosbeak.—Frequent; summer resident.

96. Indigo Bunting.—Frequent; summer resident.

97. Scarlet Tanager.—Frequent; summer resident.

98. Purple Martin.—Frequent; summer resident in town.

99. Cliff Swallow.—Common; summer resident.

100. Barn Swallow.—Abundant; summer resident.

101. Tree Swallow.—Common; summer resident.

102. Bank Swallow.—Common summer resident; abundant locally.

103. Cedar Waxwing.—Common summer resident; scarce in winter.

104. Northern Shrike.—Frequent migrant; scarce in winter.

105. Migrant Shrike.—Frequent; summer resident.

106. Red-eyed Vireo.—Abundant; summer resident.

107. Warbling Vireo.—Frequent; summer resident; local.

108. Black and White Warbler.–Common; summer resident.

109. Nashville Warbler.—Common migrant; frequent summer resident.

110. Parula Warbler.—Frequent; migrant.

111. Cape May Warbler. — Rare; spring migrant. Two seen in spring of 1908.

112. Yellow Warbler. — Common; summer resident.

113. Black-throated Blue Warbler.—Common, migrant.

114. Myrtle Warbler.—Abundant; migrant.

115. Magnolia Warbler.—Common; summer resident.

116. Chestnut-sided Warbler.—Common; summer resident.

117. Bay-breasted Warbler.—Frequent; migrant.

118. Blackburnian Warbler.—Common; migrant.

119. Black-throated Green Warbler. — Abundant migrant ; common summer resident.

120. Pine Warbler.—Rare; migrant.

121. Palm Warbler.—Scarce; migrant.

122. Oven-bird.—Common; summer resident.

123. Water-thrush.—Frequent; summer resident.

124. Mourning Warbler.—Scarce migrant. Said to breed.

125. Northern Yellowthroat.—Common; summer resident.

126. Canadian Warbler.—Frequent migrant; and probably summer resident.

127. Am. Redstart. — Common; summer resident.

128. Am. Pipit.—Frequent migrant. Often common.

129. Catbird.—Common ; summer resident.

130. Brown Thrasher.—Scarce migrant; and probably summer resident.

131. House Wren.—Abundant; summer resident.

132. Winter Wren.—Common migrant; frequent summer resident.

133. Brown Creeper.—Common migrant; frequent winter resident, and probably scarce summer resident.

134. White-breasted Nuthatch.—Common; resident.

135. Red-breasted Nuthatch. — Frequent migrant; scarce winter, and probably summer resident.

136. Chickadee.—Common; resident.

137. Golden-crowned Kinglet. — Abundant migrant ; frequent winter resident.

138. Ruby-crowned Kinglet.—Common; migrant.

139. Wood Thrush.—Frequent; summer resident.

140. Wilson Thrush.—Abundant; summer resident.

141. Olive-backed Thrush.— Frequent; migrant.

142. Hermit Thrush.—Common; migrant. May breed.

143. Am. Robin.—Abundant; summer resident.

144. Bluebird.—Common; summer resident.

II.—SPECIES NOT UNDER PERSONAL OBSERVATION.

1. Red-breasted Merganser.—Scarce; migrant.

2. Baldpate.—Scarce; migrant.

3. Green-winged Teal.—Scarce; migrant. May breed.

4. Blue-winged Teal.—Scarce; migrant. Once common.

5. Shoveller.—Rare; migrant.

6. Pintail.—Scarce; migrant.

7. Redhead.—Scarce; migrant.

8. White-winged Scoter.—A bird shot near Caledon Village.

9. Least Bittern.—One shot at the Grand River about 1878.

10. Florida Gallinule.—Scarce; migrant.

11. Am. Woodcock.—Frequent summer resident in Amaranth.

12. Least Sandpiper.—Scarce; migrant.

13. Semipalmated Sandpiper.—Scarce; summer resident.

14. Yellow-legs.—Scarce; migrant.

15. Am. Golden Plover.—Frequent fall migrant in Amaranth.

16. Semipalmated Plover. — Scarce; migrant.

17. Bob-white.—Used to be scarce resident.

18. Canada Grouse.—Used to be common resident as far south as the town.

19. Cooper Hawk.—Scarce; migrant.

20. Bald Eagle.—Scarce resident in Amaranth.

21. Duck Hawk.—Rare; migrant.

22. Barred Owl.—Used to be frequent resident in Amaranth. Last seen, 1893.

23. Am. Hawk Owl.—Frequent fall and winter migrant in Amaranth until about 1888.

24. Pileated Woodpecker.—Frequent resident until about 1887, in Amaranth and Mono.

25. Whip-poor-will.— Frequent; summer resident. Used to be common.

26. Canada Jay.—Common resident forty years ago; scarce of late. Noticed during the 1904 flight.

27. Northern Raven.—Scarce resident in Amaranth.

28. Am. Crossbill.—Irregular winter visitor.

29. Black-poll Warbler.

Gramineæ of County Peel.

BY J. WHITE, SNELGROVE, ONT.

In the following list the nomenclature used is that of Gray's New Manual, Edition VII.

Agropyrum repens, (L.) Beauv. — Very common, and a troublesome pest to the farmers.

Agrostis hyemalis, (Walt.) B. S. P. — Common in moist places.

Agrostis alba, L.—Common in low ground.

Agrostis alba, L., var. vulgaris, (With.) Thurb. — Common in meadows.

Alopecurus geniculatus, L., var. aristulatus, Torr.—Common in wet places.

Alopecurus pratensis, L.—Occasional in moist meadows.

Avena fatua, L.—Rather common in grain fields.

Bromus ciliatus, L.—Rare; in rocky woods.

Bromus Kalmii, Gray.—Not common; on sandy hills.

Bromus secalinus, L.—Common in grain fields.

Calamagrostis canadensis, (Michx.) Beauv. — Common in wet borders of boggy lakes.

Cinna arundinacea, L.—Rare; in wet woods.

Cinna latifolia, (Trev.) Griseb.—Common in moist, open swamps.

Cynosurus cristatus, L.—Occasional in lawns.

Dactylis glomerata, L.—Very common.

Danthonia spicata, (L.) Beauv.—Common on hills, in open woods.

Digitaria humifusa, Pers.—Common; in light soil.

Echinochloa crus-galli, (L.) Beauv.—Very common.

Elymus virginicus, L.—Common in shady, low woods.

Festuca elatior, L.—Common in meadows and along railroads.

Festuca nutans, Spreng.—Occasional in woods.

Festuca ovina, L.—Not common.

Glyceria canadensis, (Michx.) Trin. — Common in wet swamps.

Glyceria fluitans, (L.) R. Br. — Common on borders of boggy lakes.

Glyceria grandis, Wats.—Common in wet places.

Glyceria nervata, (Willd.) Trin.—Common in wet meadows.

Hordeum jubatum, L.—On roadsides, but not common.

Hystrix patula, Moench.—Frequent in wet woods.

Leersia oryzoides, Swartz.—Common in wet ground.

Lolium perenne, L.—Common in lawns.

Melica striata, (Michx.) Hitchc.—Rare in woods.

Milium effusum, L.—Rare in wet woods.

Muhlenbergia sylvatica, Torr.—Common along streams.

Oryzopsis asperifolia, Michx.—Frequent in woods.

Panicum capillare, L.—Common in fields.

Panicum depauperatum, Muhl.—Rare; on hillsides in shade.

Phalaris arundinacea, L.—Rare; along streams.

Phalaris canariensis, L.—Occasional about dwellings.

Phleum pratense, L. — Common everywhere.

Poa alsodes, Gray.—Rare; in wet woods.

Poa annua, L.—Common in fields.

Poa compressa, L.—Common in fields.

Poa pratensis, L.—Common in fields.

Poa triflora, Gilib.—Common in low meadows.

Setaria glauca, (L.) Beauv.—Common in fields.

Setaria italica, (L.) Beauv.—Common in fields.

Setaria viridis, (L.) Beauv.—Common in fields.

Sphenopholis pallens, (Spreng.) Scribn.—Rare; in damp woods.

NOTE.—The above list is not by any means complete, as many portions of the county have not been thoroughly gone over.

Birds on My Farm This Winter (1908-9).

BY JAMES H. CAESAR, MONO ROAD, PEEL COUNTY, ONTARIO.

The mild weather and the abundance of food seem to have been the cause of a larger number than usual of our spring and fall migrants and summer birds remaining with us this winter. In addition to these, we have our usual share of the birds that regularly remain all the year, and we have been visited by a considerable number of winter migrants.

One of the notes that is frequently heard in the woods is that of the Red-breasted Nuthatch. These little birds are continually twittering and chattering as they run up and down the trees looking for food and examining even the stumps and fallen trees for insects.

Several times I noticed one of these birds flying from a

large hemlock to the top of a beech tree and back again. On going to the hemlock to see why the bird was doing this, I saw it had something whitish in its bill, and was trying to hide it in a crevice in the bark. Just then the object slipped from its bill and fell a few feet from where I was standing. On picking it up I was somewhat surprised to find that it was a beechnut. The Red-breast was eating some of them and storing the rest away in the crevices of the bark. Those that it ate were first placed in a crevice of the bark to hold them securely until the bird could use its bill to get the kernel out.

Three Juncos are passing the winter on the farm, and occasionally they visit the manure heap near the barn to search for seeds in it.

Four or five Golden-crowned Knights are also spending the winter here. They frequently come to the orchard, and spend most of their time picking insects and insect eggs off the trees.

I was surprised to find that a song sparrow was making its home in some brush heaps at the edges of the woods. I first noticed it on January 16th, and saw it again several times afterwards. On February 3rd, two days before the writing of this article, it still was there. It fed upon the seeds of the Smartweed near the woods.

In front of our house there is a large Mountain Ash tree, which was laden with berries this year. A number of birds came to feed upon the berries as long as they lasted ; among them was a female Purple Finch, which visited the tree regularly until Christmas Day, and then disappeared.

About two weeks before Christmas I noticed a dark-colored bird accompanying some Blue Jays, which were flying from a swamp to a beech wood for beechnuts. It was about the same size as the Blue Jays, and seemed to be going for beechnuts too. On Christmas Day I noticed the Blue Jays again, and this bird with them. They lit in a large elm tree near the house, and to make sure what the bird was, I shot it, and was surprised to see it was a Bronzed Grackle.

Of the regular winter birds on the farm there are the Chickadee, White-breasted Nuthatch, Downy and Hairy Woodpeckers, Brown Creeper, Blue Jay, Great Horned Owl, Screech Owl, and this winter three or four Crows are staying around. Occasionally, too, we see a Hawk fly over.

I place pieces of meat in the trees in the orchard to attract the small birds. Three Chickadees, two White-breasted Nuthatches, two Downy Woodpeckers, and four or five Blue Jays come every day to eat the meat. They also spend considerable time in the orchard searching for food among the trees.

As winter visitors, we have on the farm the Pine Siskin, Redpoll, Pine Grosbeak, American Crossbill, White-winged Crossbill and Snowflake.

I first noticed the Pine Siskins on October 17th. Since the snow came they are feeding on the seeds of the hemlock and birch. There are a large number of these birds in the woods, and I often see as many as two or three hundred in a flock.

There are not many Redpolls; about twenty is the most I have seen at one time. They seem to be feeding on the birch and some of the smaller trees that have seeds on them. They also eat weed seeds.

The Pine Grosbeaks stay more around the orchards and house than any of the other northern birds. Six or seven of them are almost always to be seen somewhere not far from the house. Sometimes as many as thirty can be seen feeding on the frozen apples hanging on the trees. As long as the Mountain Ash berries remained these were their favorite food. The Grosbeaks visited us for the first time this year on December 17th.

I first noticed the Crossbills on October 25th. The American variety was much more common than the White-winged in the beginning of the winter. There would sometimes be forty or fifty American Crossbills and five or six White-winged ones in a flock, but lately I have seen flocks of two hundred White-winged Crossbills. They are feeding almost entirely on the seeds of the hemlock.

It is only occasionally that I see the Snowflakes, but sometimes flocks of sixty or seventy fly across the farm. The first flock was seen on December 10th.

This completes the list of birds seen on my farm this winter.

February 5th, 1909.

A Glance at Our Wild Flowers.

BY C. J. YOUNG, SNELGROVE.

Of all Canadian flowering plants, the Orchis is the most interesting and the most beautiful. We meet with it in various localities, though the rarer species must be sought for in the cool tamarack and cedar swamp. In no part of Eastern Ontario are these plants found in greater variety than in the Counties of Hastings and Northumberland. I have met with twenty-six species, and there may be others. The five "Cypripedia," or Moccasin flowers, shown in the photographs, are common; with the exception of the Ram's-head, which is everywhere rare. As far as appearance goes, these are the most interesting varieties. The showy Lady's-slipper, "Cypridedium spectabile," is the handsomest of Canadian wild flowers. It is, or was, fairly common in most parts of Ontario, having its home in the tamarack swamp or boggy meadow. As the Ram's-head appears to be the earliest of the group, this is the latest in flowering. The past season, a very late one, scarcely any were in flower before June 24th, while flowers were still numerous in cool places until the middle of July. Other members of the family are usually met with the last of May or first week in June. The search for these plants is a delightful recreation, taking one away from the much-beaten paths of every-day life. Those who are not discouraged by a few mosquitoes, or the rough paths in cool woods, will in later years look back with pleasure to such wanderings.

A list of the twenty-six species occurs in the last Bulletin, No. 3.

Bohemian Waxwing.

BY L. CAESAR.

A flock of Bohemian Waxwings, consisting of eighteen birds, was seen on the O. A. College campus at Guelph on December 30th, and remained in the vicinity for about ten days. Since that time, so far as I know, they have not been seen in this district. While here they regularly fed on the fruit of the Parsley-leaved Hawthorn (*Crataegus oxyacantha apifolia*). This is, I think, the first recorded appearance of these birds at Guelph for several years.

General Notes.

BY FRED. MITCHEL, INNERKIP, ONT.

I have little to contribute as new discoveries, etc. As late migrants from other places I may note :

Daphne Mezereum, in bloom last spring for the first time.

Grindelia Squarrosa made its first appearance three years ago, and has increased considerably at what may be its only station in the county. It is now scattered over about two acres.

Vaccaria Vulgaris.—Two plants found near Innerkip last season.

Neslia Paniculata has become quite common all at once.

Ixophorus verticillatus, a rather late arrival, is increasing very fast, and it would seem that it may become as bad a weed as the other foxtail grasses. I may assume that it is not yet extended to or beyond the eastern limit of the county, as it is not included in Mr. Herriott's list of the Grasses of Galt and Vicinity.

I discovered another station of Epigaea Repens the past season. This, and another station of importance, is all I now know of in the county.

DISTINCT SPECIES OF SOLIDAGO OF OXFORD COUNTY.

In the autumn the genus Solidago is universally in evidence. It is all about us; it is tinging the hills miles away. It ribbons the fence limits of cultivated fields, and the roadsides are lined with it. Unbroken grazing lands seem to be but little else. It is a prominent feature of the borders of the woodlands, and a striking part of the decorative flora of rocky hills or quaking bogs. We see it flourishing in rich clay or arid land, and in many of these situations presenting a great diversity of appearance. One would suppose that with all this representation and diverse form it would be easy to form a large list of species in almost any locality, but my experience is against this. For the past two seasons I have been trying to separate the multitudinous representation of the genus into distinct species, and I have as yet but seven. There are none of these which intergrade with any other member of the list. The list is as follows :

Canadensis.—The most abundant species, and ever-varying in appearance. From this could be selected specimens of the so-called Serotina, and others, but if we follow these seeming species through a number of individuals in the endeavor to find a distinctive line of separation between these and Canadensis, all we find is all grades of intermediate form, but no line of separation. This was my experience, and I felt it was safest to follow the suggestion of Prof. A. Gray and consider all of the Canadensis type to be but representatives of one polymorphous species. The ordinary agriculturist regards this species as a weed.

Lanceolata, an immigrant of the last few years, is next to Canadensis in abundance, and is increasing very fast. In some places there are now acres of it, where a few years ago it was unknown. If it is a member of the genus at all it is a most unvarying species.

Flexicaulis is rather frequent in partial shade. It varies considerably in its inflorescence, and I have some hopes that I can yet separate another species from this.

Patula is rather common in wet places, and is a most distinctly marked species. It could easily be identified in the dark by the extreme roughness of its leaves.

Uliginosa is only found in very wet places — quaking bogs and the like. In these situations it is rather common. It is another very plainly marked species.

Caesia, var. Axillaris, perhaps is distinct locally, but limited in quantity. It is scattered for a mile or more along the steep south bank of the Thames River. It is noticeably distinct from any other species of the district.

Rugosa is fairly abundant, but there is nothing about it to induce apprehension that it may become a weed. It seems to be a true native species, and in no way aggressive. I would extend my notes of this species somewhat, as I know its study has been discouraging to some of our young students. It is in itself as a species very distinctively marked, but descriptive lists are very confusing regarding it. Early lists made two species of it, one being called Rugosa and the other Altissima, the latter name being very misleading, as it is by no means tall. Some lists still retain the misleading name, in preference to the suggestive one. One of our popular botanies gives its maximum height as seven inches; another as seven and a half feet; and another, which is in common use as a handbook for High School students, gives it as *less than a foot*, and this is printed in italics, as a particularly distinctive mark of the species. Another list, now out of general use (Torrey's), gives the maximum height as four or five feet, which is nearly as it is seen here. This list was, no doubt, prepared from personal observation. The species is not quite uniform in appearance here, but I thought I could always trace any variation to some local influence. As an example of this, I may cite the case of a new field in which some Rugosa plants were plowed under in the spring, and later the succeeding plants were found to be quite changed in appearance—the leaves were broader, and the infloresence more profuse. I consider the species as we have it here, after taking local conditions into consideration, to be a distinct one. It is always noticeably rugose, and averages

at least a foot lower than Canadensis. One thing which I think I have learned in my study of this genus, is, that in order to arrive at true conclusions, it is safest to study it in the field. Collected specimens, if dry, may have become unnatural, and even if fresh, may be that of extremely marked individuals.

The Polyporaceæ in the Vicinity of the Ontario Agricultural College, Guelph.

The following list does not pretend to be complete, as the species mentioned were only collected incidentally whilst other material was being sought. It may, however, be of interest as indicating which species are most frequently found in the immediate vicinity of the College. It is hoped next season to extend considerably the observations made during the past year.

The nomenclature followed is that given by W. A. Murrill in the section "Polyporaceæ," of the North American Flora, but the older and usually better-known name is given where this differs. Unless otherwise stated, the species were found on dead wood.

Irpiciporus lacteus, (Schw.) Murrill. (Irpex lacteus, Fr., and other species.)

Poronidulus conchifer, (Schw.) Murrill. (Polystictus conchifer, Schw.)

Coriolus versicolor, (L.) Quel. (Polystictus versicolor, (L.) Fr.—Frequent.

Coriolus nigromarginatus, (Schw.) Murrill. (Polystictus hirsutus, Fr.)

Hexagona alveolaris, (D. C.) Murrill. (Favolus canadensis, Klotzsch.)

Polyporus elegans, (Bull.) Fries.

Pycnoporus cinnabarinus, (Jacq.) Karst. (Polystictus cinnabarinus, (Jacq.) Fr.—Not common.

Elfvingia megaloma, (Lev.) Murrill. (Fomes megaloma, Lev.)—On dead or dying wood. Common.

Ganoderma Tsugae, Murrill. (Polyporus lucidus, (Leys) Fr., in part.)

Daedalea confragosa, (Bolx.) Pers.

The following are added, on the authority of Mr. T. B. Rivett :—

Polyporus picipes, Fr.

Boletus americanus, Pk.

Boletus Clintonianus, Pk.

Boletus luteus, L.—Under pines.

Boletinus paluster, Pk.—Near pines.